

**PCT**

NOTIFICATION OF TRANSMITTAL
OF COPIES OF TRANSLATION
OF THE INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY
(CHAPTER I OR CHAPTER II
OF THE PATENT COOPERATION TREATY)
(PCT Rules 44bis.3(c) and 72.2)

From the INTERNATIONAL BUREAU

To:

HIGASHIMA, Takaharu
HIGASHIMA PATENT OFFICE
2-14, Umeda 3-chome
Kita-ku, Osaka-shi
Osaka, 5300001
JAPON

Daiko Building

Date of mailing (day/month/year) 18 May 2006 (18.05.2006)	
Applicant's or agent's file reference KE34000-P0 665981	IMPORTANT NOTIFICATION
International application No. PCT/JP2004/011936	International filing date (day/month/year) 19 August 2004 (19.08.2004)
Applicant THE KANSAI ELECTRIC POWER CO., INC. et al	

1. Transmittal of the translation to the applicant.



The International Bureau transmits herewith a copy of the English translation of the international preliminary report on patentability (Chapter I).



The International Bureau transmits herewith a copy of the English translation of the international preliminary report on patentability (Chapter II).

2. Transmittal of the copy of the translation to the designated or elected Offices.

The International Bureau notifies the applicant that copies of that translation have been transmitted to the following designated or elected Offices requiring such translation:

None

The following designated or elected Offices, having waived the requirement for such a transmittal at this time, will receive copies of that translation from the International Bureau only upon their request:

AE, AG, AL, AM, AP, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EA, EC, EE, EG, EP, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OA, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW

3. Reminder regarding translation into (one of) the official language(s) of the elected Office(s).

The applicant is reminded that, where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability (Chapter II).

It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned within the applicable time limit (Rule 74.1). See Volume II of the PCT Applicant's Guide for further details.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer

Yoshiko Kuwahara

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference KE34000-P0	FOR FURTHER ACTION	See item 4 below
International application No. PCT/JP2004/011936	International filing date (<i>day/month/year</i>) 19 August 2004 (19.08.2004)	Priority date (<i>day/month/year</i>) 22 August 2003 (22.08.2003)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant THE KANSAI ELECTRIC POWER CO., INC.		

1.	This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).																								
2.	This REPORT consists of a total of 6 sheets, including this cover sheet.																								
	In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																								
3.	<p>This report contains indications relating to the following items:</p> <table style="width: 100%;"> <tr> <td style="width: 10%; text-align: center;"><input checked="" type="checkbox"/></td> <td style="width: 30%;">Box No. I</td> <td style="width: 60%;">Basis of the report</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>	<input checked="" type="checkbox"/>	Box No. I	Basis of the report	<input type="checkbox"/>	Box No. II	Priority	<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input checked="" type="checkbox"/>	Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/>	Box No. VI	Certain documents cited	<input type="checkbox"/>	Box No. VII	Certain defects in the international application	<input type="checkbox"/>	Box No. VIII	Certain observations on the international application
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<input type="checkbox"/>	Box No. VII	Certain defects in the international application																							
<input type="checkbox"/>	Box No. VIII	Certain observations on the international application																							
4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Date of issuance of this report 08 May 2006 (08.05.2006)
Facsimile No. +41 22 740 14 35	Authorized officer <div style="text-align: center; font-weight: bold;">Yoshiko Kuwahara</div>
Telephone No. +41 22 338 90 90	

PATENT COOPERATION TREATY

TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

Date of mailing
(day/month/year)

Applicant's or agent's file reference
KE34000-P0

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/JP2004/011936

International filing date (day/month/year)
19.08.2004

Priority date (day/month/year)
22.08.2003

International Patent Classification (IPC) or both national classification and IPC

Applicant
THE KANSAI ELECTRIC POWER CO., INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/JP

Authorized officer

Facsimile No.

Telephone No.

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/JP2004/011936

Box No. I

Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rule 12.3 and 23.1(b)).
2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material
☐ a sequence listing
☐ table(s) related to the sequence listing
 - b. format of material
☐ in written format
☐ in computer readable form
 - c. time of filing/furnishing
☐ contained in the international application as filed.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/JP2004/011936

Box No. IV

Lack of unity of invention

1. ☐ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has:
- ☐ paid additional fees
 - ☐ paid additional fees under protest
 - ☐ not paid additional fees
2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with
 - ☒ not complied with for the following reasons:

Claims 1-12, 15-16 are inventions relating to a semiconductor device that uses a wide gap-type semiconductor and has the special feature of letting the said semiconductor device operate at a higher temperature than normal room temperature.

Claim 13 is an invention relating to the manufacturing method for a semiconductor device having the special feature of irradiating semiconductor elements using SiC - the cathode area, the drift area, the base area and the anode area - with an electrode beam.

Claim 14 is an invention relating to the manufacturing method for a semiconductor device having the special feature of letting an electric current flow in the direction of easy flow between the anode and the cathode and letting a stacking fault occur in the drift layer and the anode area.

Therefore, the claims in this application describe three inventions, separated into claims 1-12 and 15-16, claim 13 and claim 14.

4. Consequently, this opinion has been established in respect of the following parts of the international application:

☒ all parts

☐ the parts relating to claims Nos. _____

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/JP2004/011936

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims		YES
	Claims	1 - 16	NO
Inventive step (IS)	Claims		YES
	Claims	1 - 16	NO
Industrial applicability (IA)	Claims	1 - 16	YES
	Claims		NO

2. Citations and explanations:

Document 1: Yoshitaka SUGAWARA 'Recent Progress in SiC Power Device Developments and Application Studies.' 2003 IEEE 15th International Symposium on Power Semiconductor Devices and ICs Proceedings, 14 April, 2003 (14.04.03), pages 10-18, Full text

Document 2: Anant K. AGARWAL et al. '4H-SiC p-n diodes and gate turnoff thyristors for high-power, high-temperature applications.', Solid-State Electronics, Vol. 44, February 2000 (02.00), pages 303-308, Full text

Document 3: JP, 9-148681, A (Sumitomo Electric Industries, Ltd.), 6 June, 1997 (06.06.97), [0005] - [0007]

Document 4: JP, 10-22495, A (Meidensha Corp.), 23 January, 1998 (23.01.98) [0029] [0041] - [0055]

Document 5: JP, 8-18030, A (Fuji Electric Co., Ltd.), 19 January, 1996 (19.01.96), [Abstract], [Claim 1], [Claim 2] [0007]

Document 6: JP, 2001-217363, A (Hitachi, Ltd.), 10 August, 2001 (10.08.01), [0028] - [0034] [0045]

Document 7: JP, 2002-325355, A (The Kansai Electric Power Co., Inc.), 8 November, 2002 (08.11.02) [0050] - [0054]

Document 8: M. E. TWIGG et. al., 'Structure of stacking faults formed during the forward bias of 4H-SiC p-i-n diodes.' APPLIED PHYSICS LETTERS, Vol. 82, No. 15, 14 April, 2003 (14.04.03), pages 2410-2412, Full text

Document 9: JP, 2002-325427, A (The Kansai Electric Power Co., Ind.), 8 November, 2002 (08.11.02), [0030] - [0032] [Fig. 8]

Claims 1-16

Document 1 describes the structure of semiconductor devices such as GTO, pn diodes, etc. using wide gap semiconductors such as SiC, and the inventions of claims 1-16 are a part of the above constitution.

Claims 1, 2, 5-7, 10, 11

Document 2 describes a constitution relating to a GTO, p-n diode operating at a temperature of 500 °C.

Document 3 describes a constitution where a heater is provided in the package to heat the semiconductor elements in the package.

Applying the constitution of providing a heater in the package described in document 3 to the constitution of heating the elements described in document 2 is a matter that a person skilled in the art could easily conceive of.

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/JP2004/011936

Box No. V

Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement

Claims 3, 4, 13

As described also in document 4 and document 5, the idea of irradiation with electron beams to control the lifetime of the carrier is a well-known art, and the control of the lifetime of the carrier is a matter that should naturally be considered also in the constitution described in document 2. Therefore, applying the art of electron beam irradiation described in documents 4, 5 to the invention described in document 2 is a matter that a person skilled in the art could easily conceive of.

Claims 8, 9

Document 6 describes a constitution relating to a package performing heat control using a heat sink. The idea of mounting the semiconductor device described in document 2 in the package described in document 6 is a matter that a person skilled in the art could easily conceive of.

Claim 12

Document 7 describes a semiconductor device providing a wide-gap bi-polar light-emitting element using a wide-gap semiconductor and a wide-gap photo diode using a wide-gap semiconductor. The idea of using an element using a wide-gap semiconductor after heating it is described in document 2, and the idea of providing a heating means in the package is also described in document 3.

Therefore, no inventive step can be recognized in the idea of using the package described in document 3 in order to use the semiconductor device described in document 7 in a heated condition.

Claim 14

Document 8 describes the fact that a fault occurs when letting an electric current flow in the direction of easy flow in SiC p-i-n diodes.

The invention of claim 14 does not appear to be novel because it is a part of the SiC p-i-n diodes described in the above document 8.

Claims 15, 16

Document 9 describes a power conversion device using a GTO thyristor and diodes consisting of wide-gap semiconductors.

Document 8 describes a diode consisting of a wide-gap semiconductor.

Document 2 describes the idea of letting a semiconductor device consisting of a wide-gap semiconductor operate at a predetermined temperature.

The idea of making the diode of the power conversion device described in document 9 the diode consisting of a wide-gap semiconductor described in document 8 is not recognized as involving an inventive step. And the idea of letting it operate at a predetermined temperature, and the idea of providing a means to keep that temperature are a natural constitution when letting it operate at a predetermined temperature.